Autonomous Navigation for Exploration on Icy Moons

Completed Technology Project (2016 - 2018)

Project Introduction

The proposed program develops novel sensing, perceptual models, and energy-efficient exploration strategies to enable mobile autonomous systems to explore icy moons and identify high value science targets. The research program will yield: (1) a novel active illumination sensor that can selectively image certain types of light paths while blocking others with the capability to scan optically challenging materials such as ice; (2) a probabilistic sensor model that accurately captures sensor measurements and incorporates intensity, depth, and material information; and (3) an energy-efficient motion planning framework that yields maximally informative and energy efficient trajectories that generalize across multiple mobility platforms. Integrative experiments will validate the developments at sites in Pennsylvania that exhibit similar characteristics as the anticipated craggy, icy environments. Each field experiment will emphasize in-situ evaluation and validation of the proposed approach.

Anticipated Benefits

This project aims to develop the following to enable mobile autonomous exploration of icy moons and identification of high value science targets: (1) a novel active illumination sensor that can selectively image certain types of light paths while blocking others with the capability to scan optically challenging materials such as ice; (2) a probabilistic sensor model that accurately captures sensor measurements and incorporates intensity, depth, and material information; and (3) an energy-efficient motion planning framework that yields maximally informative and energy efficient trajectories that generalize across multiple mobility platforms.

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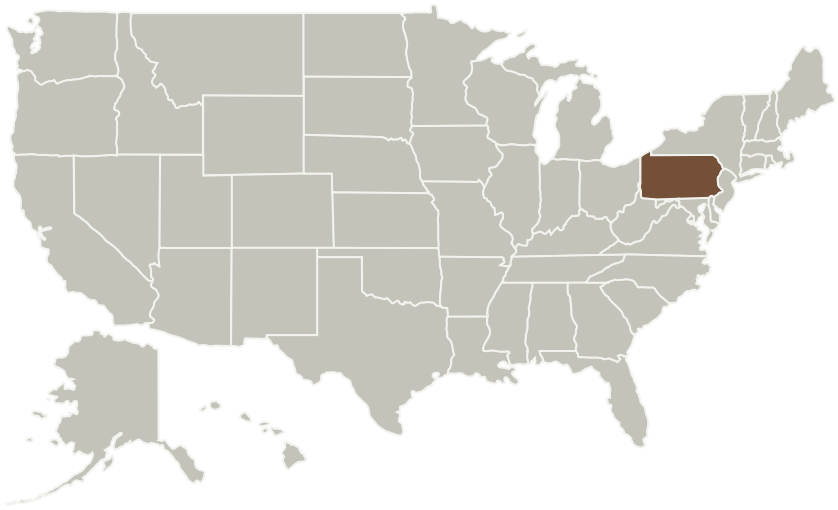
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Carnegie Mellon University	Lead Organization	Academia	Pittsburgh, Pennsylvania

Primary U.S. Work Locations
Pennsylvania

Project Website:

https://www.nasa.gov/directorates/spacetech/home/index.html

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Carnegie Mellon University

Responsible Program:

Space Technology Research Grants

Project Management

Program Director:

Claudia M Meyer

Program Manager:

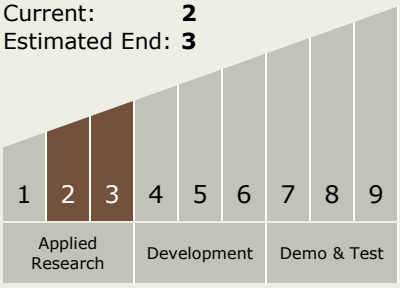
Hung D Nguyen

Principal Investigator:

Nathan Michael

Technology Maturity (TRL)

Start: **2**
Current: **2**
Estimated End: **3**



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Technology Areas

Primary:

- TX04 Robotic Systems
  - TX04.2 Mobility
    - TX04.2.4 Surface Mobility

Target Destination

Others Inside the Solar System